

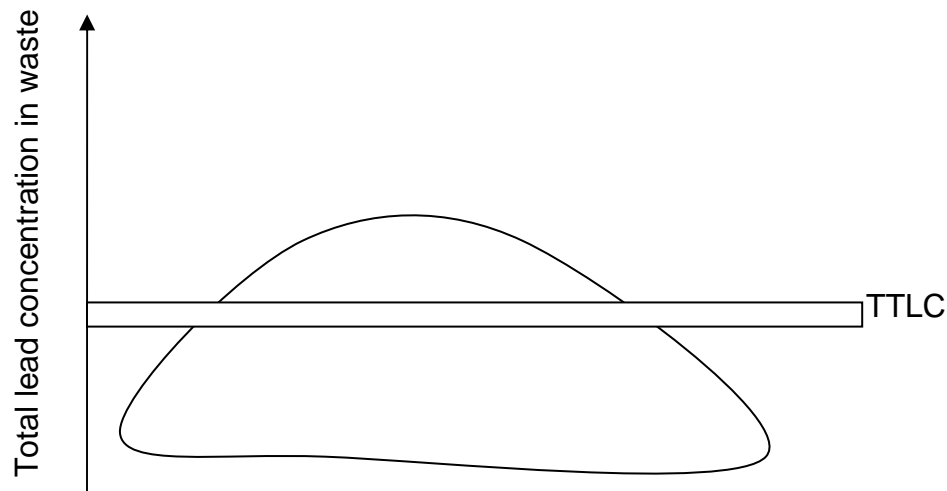
## Total Threshold Limit Concentration – Lead Summary of Approach

### Introduction and Background:

The goal of this project is to update the total threshold limit concentration (TTLC) for lead to better reflect more recent findings regarding the health impacts associated with lead. The TTLC is one of the characteristics used to determine if a waste is considered hazardous and it is intended to protect receptors from direct exposure to the waste.

The objective of this project is to revise the TTLC for lead to improve protection of the general population, including children, from direct exposure to lead-containing waste, including contaminated soil. A waste whose total lead concentration exceeds the TTLC is considered hazardous and must be managed in accordance with requirements that protect the population and environment from adverse effects associated with the waste - from the time it is generated to the time it is disposed. Among other provisions, state statutes require DTSC to adopt regulations establishing criteria and guidelines to identify hazardous waste that may pose a hazard to human health or the environment when the waste is improperly managed (Health and Safety Code (HSC) section 25141).

Wastes that are identified as hazardous according to the state's laws and regulations are subject to a variety of handling, management and disposal requirements intended to protect the public health and safety and environment from adverse effects associated with the waste. At times these requirements may be violated, sometimes intentionally, sometimes not, and as a result the public and environment may come in contact with the waste. It is for this type of exposure the TTLC is intended to provide protection.



Just as the TTLC represents the lower limit of total lead measured in a hazardous waste, it also represents the upper limit of total lead allowable in a waste that has been determined to be non-hazardous using this threshold. A waste whose total lead

concentration does not exceed the TTLC may be considered non-hazardous, *if the waste exhibits no other characteristics, or fulfills no other conditions of a hazardous waste*. The management of non-hazardous wastes is not as closely controlled as hazardous waste and direct contact of the general population with such a waste can and often does occur. This potential for exposure helps to drive the need for a TTLC value for lead that better reflects the risk of lead exposure and accurately identifies those wastes that should be properly managed as hazardous wastes.

In general the existing TTLCs in the state's regulations are based on general measures of toxicity. As described in DTSC's Lead Report, the original TTLC for lead was developed in the late 1970s/early 1980s. It was initially based on the STLC value for lead, but the calculated lead TTLC of 500 mg/kg was adjusted to 1,000 mg/kg on the basis of findings regarding mean soil lead levels and acceptable child exposure to contaminated soil. In this instance, the traditional basis for the calculation of the TTLC for lead was modified at that time by consideration of data regarding health effects. These findings, particularly those associated with child exposure to lead-contaminated soil, are now outdated and form the focus for DTSC's effort to update the TTLC. The current approach DTSC proposes to use to update the TTLC also considers health effects to modify the TTLC for lead.

### **DTSC's Approach**

DTSC considered several options for updating the TTLC for lead and examined the extent to which each could achieve the goal of this project. The alternatives considered included:

- Recalculating the toxicity-based TTLC, but correcting the original assumptions
- Recalculating the TTLC using a health-based model to account for consideration of health effects associated with lead exposure.

The first option omits the adjustment of the calculated TTLC, and thereby eliminates the use of obsolete assumptions regarding direct contact with soil contaminated with lead. While this approach better reflects our current understanding of the health impacts associated with direct exposure to lead-containing waste by disregarding the outdated information, it does not directly update those assumptions. This approach, as initially conceived, only partially meets our goal for this project.

The second option achieves the goal of this project because it updates the TTLC for lead using a model that calculates blood lead concentration resulting from exposure to lead-containing media. Blood lead concentrations can be correlated to various health effects associated with direct exposure to lead and can be used to account for the health impact associated with direct exposure to lead-containing wastes.

DTSC considered two models for the second option, U.S. EPA's Integrated Exposure, Uptake and Biokinetic Model (IEUBK) and DTSC's Leadsread 7. The IEUBK models blood lead concentration in children from an absorbed dose of lead. This model accounts for changes in diet and water consumption with age, and makes pharmacokinetic corrections to account for changes in factors such as gastrointestinal

absorption of lead and storage in bone and soft tissue as children age. Leadsread predicts lead concentration in children and adults from an applied lead dose determined from inputs from soil and dust, water, air and food. Like the IEUBK, Leadsread uses slope factors to estimate blood concentration resulting from an environmental input. A slope factor is the change in blood lead concentration resulting from each  $\mu\text{g}/\text{day}$  of lead intake.

Leadsread is not as detailed as the IEUBK, but it is commonly used to calculate target soil concentrations for exposure by a 2-3 year old child or an adult based on specified values for the inputs for lead in air, water and food. DTSC selected Leadsread 7 to calculate the TTLC for lead for this project due to this ability to back-calculate general, state-wide soil concentrations for children and adults using specified parameter values and a target blood lead concentration.

### **Assumptions and Calculations**

To select the parameter values for calculating the lead concentration using Leadsread, DTSC developed an exposure scenario based on the type of potential exposure for which the TTLC is intended to provide protection, namely, direct exposure to the waste. If hazardous wastes are managed properly, in compliance with DTSC's requirements for the generation, management and disposal of such wastes, direct exposure to the general public is minimized. At times, however, hazardous wastes are improperly managed or disposed. If this happens, direct exposure of the general public to hazardous waste could occur and the TTLC should be established at a level to ensure that appropriate enforcement can be implemented to prevent adverse effects resulting from such exposure.

DTSC's exposure scenario assumes direct exposure of the general population to waste containing total lead at concentrations at or above the TTLC for lead, resulting from mismanagement or inappropriate disposal of hazardous waste outside of permitted facilities. The waste matrix is assumed to be primarily soil, ash or sludge-like material and lead-paint containing debris. The exposed population is assumed to be adults or children, and the exposure locations are assumed to be locations where the general public might encounter improperly disposed wastes, such as vacant lots, parks or roadsides in residential, industrial, rural or mixed use neighborhoods, or locations where child-occupied buildings are inadvertently constructed adjacent to or on top of sites where mismanagement or improper disposal of hazardous waste occurred in the past, throughout the state. The potential routes of exposure are assumed to be ingestion and inhalation. In using Leadsread to calculate the TTLC, DTSC also assumes lead-contaminated soil serves as a surrogate for waste containing lead.

To calculate a TTLC value that could be applicable statewide DTSC used default values for most of the input parameters in Leadsread. DTSC used a value of  $5 \mu\text{g}/\text{L}$  for lead in drinking water rather than the conservative default level of  $15 \mu\text{g}/\text{L}$  since the statewide average for lead in drinking water is likely to be less than  $5 \mu\text{g}/\text{L}$ . DTSC also did not include backyard gardening in the exposure setting, since DTSC did not envision

exposure to improperly disposed wastes from produce grown in backyard gardens was likely to occur commonly in the exposure scenario statewide.

In calculating its range of TTLC values, DTSC used a target blood lead concentration of 10 µg/dL. Using these input values, DTSC calculated the lead concentrations for child exposure at the 99<sup>th</sup> and 95<sup>th</sup> percentile confidence intervals. The results of these calculations are tabulated below.

#### **Leadsread 7 soil concentration calculations (ug/g)**

	BLL = 10 µg/dL	
	99%	95%
Child	344	525

As discussed in the Lead Report, recent research suggests adverse health effects, primarily cognitive deficits, may occur at blood lead levels below the level of 10 µg/dL, which is the level of concern for certain interventions specified by the federal Centers for Disease Control and Prevention (CDC). Rather than lowering the blood lead level of concern further in response to this research, the CDC recommends strategies that prevent childhood exposure to lead. Although DTSC recognizes that the level of concern of 10 µg/dL is currently considered high, Leadsread 7 has been designed to be used with 10 µg/dL as the parameter value for target blood lead concentration. In the absence of a national consensus regarding what the alternative target blood lead concentration should be, DTSC is proposing that a TTLC based on the value of 10 µg/dL for blood lead level serves the objective of updating the TTLC, especially when considering that the CDC blood lead level of concern was 30 µg/dL at the time the original TTLC for lead was developed.

#### **Conclusion**

DTSC considers the proposal outlined in this document to be a starting point for discussion at the workshop. DTSC is interested in public input and suggestions regarding its goals, approach, assumptions and calculations. In particular, DTSC is interested in the following questions:

- Are there other exposure scenarios DTSC should consider?
- Is there justification for input values other than the default values used in Leadsread?
- Is there another approach to updating the TTLC for lead that DTSC did not consider?